In re investigation of accident on the Pennsylvania R. R., near Sizerville, Pa., on January 30, 1915.

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On January 30, 1915, there was a collision between a freight train, a light engine and another freight train, on the Pennsylvania R. R., near Sizerville, Pa., resulting in the death of one employee and the injury of three employees.

The leading train was 2nd No. 96. It was made up at Olean, N. Y., and left that point southbound, as 1st No. 96 at 7:13 p.m., January 29, with Conductor Nelson and Engineman Scanlon in charge. The train consisted of an engine, 43 cars loaded with oats, and a caboose, all equipped with air brakes reported to be in working order at the beginning of this trip. Stops were made at Eldred, Port Allegany, and Relay, 13.8 miles, 26.1 miles, and 33.0 miles respectively, from Olean, the brakes apparently working properly. At Relay this train was held for about six hours, and during this time an air brake hose on the rear of the tender and the distributing valve on the engine were frozen. After these had been thawed out, and shortly before the train left that point, a test of the brakes was made and all except four of the brakes were reported working. While at Relay a following section passed, this train then becoming 2nd No. 96. Two helping engines were coupled on and pushed the train to Keating Summit, a distance of 3.9 miles; at Keating Summit the helping engines were detached, the speed of the train then being approximately 15 miles per hour.

Engineman Scanlon of 2nd No. 96 stated that he made a 25-pound reduction at Olean for the brake test. At Eldred the air worked properly, but the brakes did not seem to hold very well. At Port Allegany and Relay the brakes apparently worked properly, and just before leaving Relay, after the frozen air brake hose and valve had been thawed out, he made a 10-pound reduction and the train line exhaust was all right. One of the trainmen examined the brakes in the train and told him all except four were working. After starting down the grade south of Keating Summit he made a reduction of 15 pounds; the exhaust was bad and it took some little time to make this reduction. As this did not seem to check the speed of the train he made another reduction of 10 pounds, and soon afterwards he called for hand brakes. When he released to recharge, the train line pressure had leaked down about 10 pounds more. He then made another brake application, reducing 15 pounds and then 10 pounds and got a better train line exhaust, and soon afterwards he had the train under control. He thought the maximum speed of his train on this grade was about 35 miles per hour. At Sizerville, 7.7 miles from

Keating Summit, the speed of the train had been reduced to about 20 miles per hour; the engineman stated he then had control of the train and could have stopped had the signal been set against him. About a mile beyond Sizerville the reach rod of the engine broke, the engineman applied the brakes in emergency, and the train was stopped. On account of this and other defects which had developed the engineman was unable to move the engine, and the conductor went back to Sizerville to report to the dispatcher.

There were two brakemen and a flagman on this train. When train 2nd No. 96 started down the grade the head brakeman and the rear brakeman had set up retainers and had met on top of the train at about the middle of it when the engineman called for hand brakes; they immediately began to set the brakes, both working towards the engine. The conductor was also on top of the train setting brakes near the rear end; about 20 or 25 hand brakes had been set when the train passed Sizerville. The flagman of this train was killed in the collision.

Extra engine No. 3013, running backwards down the hill, followed 2nd No. 96 from Keating Summit and was stopped by the flagman a short distance behind 2nd No. 96 approximately one mile south of Sizerville. The fireman then went back with a flag to protect his engine.

Third No. 96, consisting of an engine, 42 cars loaded with cats, and a caboose, with Conductor Ellis and Engineman Baker in charge, left Olean at 2:36 a.m., January 30. The brakes on all except one of the cars in this train were reported to be in working condition, the brakes on this one car being cut out. At Portville, 5.5 miles from Olean, one car was set out and the brakes on the train were tested before leaving this point. At Limbee, 17 miles from Olean, where this train took water, and at Port Allegany, brake tests were also made; it was found in these tests that in addition to the one car which was cut out, the brakes on two or three other cars leaked off when the tests were made. At Relay two pusher engines were coupled on the rear end and a test of the brakes was made; the helper engines pushed the train to Keating Summit and were cut off at that point, the speed of the train then being probably about 15 miles per hour. On the grade south of Keating Summit the engineman made a service application of the brakes, but this application had little effect, and he then made an emergency application and sounded the whistle for the hand brakes, repeating this signal several

times; he also reversed the engine, but the train continued to gain speed and soon was beyond control.

Engineman Baker of train 3rd No. 96 stated that he made a 25-pound reduction for the air-brake test at Olean and that he was informed 41 brakes were working, the train consisting of 42 cars. Afterwards stops were made at Olean, Portville, Larabee, Port Allegany and Relay, an inspection and test of the brakes being made at Larabee, Port Allegany and Relay. After starting down the hill south of Keating Summit when the train was running 10 or 15 miles per hour he made a reduction of about 10 pounds and then another reduction of about 8 pounds. He said he got a good train line exhaust although it seemed to require a rather long time. This brake application appeared to have no effect. The speed then having increased to 18 or 20 miles per hour, he sounded the whistle signal for hand brakes and placed the brake valve in emergency position. The emergency application did not check the speed, but the speed did not increase so rapidly afterwards. He reversed the engine and the packing blew out of one of the cylinders. The driver and tender brakes seemed to be working properly, the driver brake becoming locked before the train reached Sizerville. He did not think the speed of the train exceeded 40 miles an hour at any time on the hill. He repeated the whistle signal for brakes several times, and as the train approached Sizerville the speed began to decrease somewhat. Before the collision occurred the engineman and fireman of this train got off, having seen smoke and steam from the light engine, as well as warning signals of sectionmen. This train passed Sizerville at 7:14 a.m., passed the block signal at danger, and the flagman of extra engine 3013, and a moment or two later it collided head-on with engine No. 3013 which was standing a few car lengths in rear of 2nd No. 96; the momentum of this train and the force of impact carried 3rd No. 96 and the light engine with great force against the rear end of 2nd No. 96. Both locomotives were turned over and 25 cars and one caboose were wrecked.

The brakemen set up the retainers while the train was going up the hill north of Keating Summit, and after starting down the hill south of Keating Summit they saw the conductor setting brakes near the rear end and they also began to set the hand brakes, one working toward the head end and one toward the rear end; about 25 brakes were set altogether. The conductor and engineman both stated that they could assign no cause for the running away of the train except that the brakes did not hold.

Between Relay and Keating Summit the air was cut through to the helper engines and the brake valves were cut out; the engineman of the rear helping engine stated that just before the angle cocks were closed between pusher engines and caboose, preparatory to cutting off the pusher engines, his air gauge registered 85 or 90 pounds. He thought the speed of the train was about 15 miles per hour when his engine was cut off.

The flagman of train 3rd No. 96 stated that the train was running about 20 miles per hour when it passed Keating Summit and the helpers were cut off. He said he noticed the first application of the air brakes. He set the caboose brake but did not go out on top of the train. The conductor stated the train passed Keating Summit at about seven o'clock, and the flagman said it was 7:01, but two operators who were in the block office stated it passed that point at 7:03. One of the operators estimated the speed of the train at that time at about 15 miles per hour, and the other thought it was between 15 and 20 miles per hour.

Between Keating Summit and Sizerville the speed of freight trains is restricted by time card rule to 20 miles per hour, the minimum running time being 23 minutes. According to the statements of operators and the record on the dispatcher's train sheet, 2nd No. 96 passed Keating Summit at 4:50 a.m., and Sizerville at 5:01 a.m.; 3rd No. 96 left Keating Summit at 7:03 a.m., and passed Sizerville at 7:14 a.m., both trains running the distance of 7.7 miles between those stations in 11 minutes, or at an average speed of 42 miles per hour.

That part of the Buffalo Division on which this accident occurred is a double track line operated by the telephone block system. Between Keating Summit and Sizerville an absolute block for all southbound trains is maintained, except that it is the practice for light engines to follow other than first-class trains, such movements being authorized by train orders. Between Sizerville and Emporium Junction permissive blocking for all except first-class trains is permitted.

From Port Allegany to Keating Summit, a distance of approximately 11 miles, there is a practically continuous ascending grade for southbound trains, the maximum gradient being about 1.6 per cent., and from Keating Summit to the point of accident, a distance of 3 miles, there is a descending grade for southbound trains, the grade varying from 2 to 2.3 per cent for a distance of five miles, and decreasing to .3 per cent at Sizerville. At the point where the accident occurred the grade was .6 per cent, descending for southbound trains.

Proceeding south from Sizerville station there is a 1-degree 30 minute curve toward the west, 3,122 feet long, then a tangent of 1,861 feet, followed by a 2-degree curve to the west 1,092 feet long and then a tangent of 200 feet to point of accident.

At the time the accident occurred the weather was clear and very cold, the thermometer registering about 22° below zero.

The cars in these trains were of 60,000 and 80,000 pounds capacity, their light weight averaging approximately 37,000 lbs., and the braking power being approximately 70% of the light weight. The total weight of cars and lading in these trains was 48 or 60 tons per car.

Air brake inspectors are stationed at Buffalo and at Olean, and there are supplies and facilities at those points for making necessary adjustments, renewals and repairs. The air brake practices in effect at those points are such that trains are not permitted to leave with less than 85% of the cars equipped with brakes in operation, and the records maintained at those points indicate that the percentage usually obtained is much higher or nearly 100 per cent. Investigation disclosed, however, that cars are permitted to leave both Buffalo and Olean with the brakes cardied as defective but not cut out of service; and these are counted as operative brakes when the percentage of brakes working in the train is figured.

Both trains 2d and 3d No. 96 were trains of grain and were made up at Olean. The cars composing these trains had been in the yard at that point for some time but until they were about to move forward no attention had been paid to the brake equipment. The cars in these trains were all foreign cars, most of them belonging to the Grand Trunk System.

When these trains were being made up the usual air brake inspections and tests were made, and with the exception of one car in train 3d No. 96, on which the brake was cut out, such defects as were found were adjusted or repaired. In making the inspection and test in this yard the yard pipe line, carrying from 70 to 80 pounds air pressure, is coupled to the train line and the inspectors then examine the train for leaks, replacing defective air-hose or gaskets, tightening leaky joints, and making other similar repairs. The retaining valve handles are then turned up and a reduction of train line pressure is made for the purpose of applying brakes. The inspectors then examine the piston travel on all the cars, and in case the piston travel is too long or too short a mark is made on the side of the car, indicating that adjustment is necessary. The brakes are then released and another inspection is made to determine whether or not the retainers are in proper

condition. If in this inspection a car is found on which the brake has leaked off another mark is made on the car, indicating that the retainer requires adjustment or repair. When this last inspection has been made the repairs or adjustments noted are made and the inspectors then test the brakes and retainers again to insure that they are working properly. When the road engine is coupled on the inspectors inform the engineman of the number of cars in the train and the number of brakes working, and also make a test of the brakes to insure that they apply and release throughout the train.

Ordinarily in making the air-brake inspection and tests in the yard at Olean the connection between the yard pipe line and the air-brake train line is supplied with an air gauge and a small pet-cock. In making the brake application for purposes of test a reduction of 25 pounds is made, the amount being noted on the gauge and the air being drawn off gradually through the pet-cock, the purpose being to provide an application similar to a full service application made by the engineman through the brake valve. When trains 2d and 3d No. 96 were made up, however, this apparatus was not used, it being out of order. The brake pipe reduction was made by opening an angle cock in the train line; the amount of this reduction was estimated by the inspectors to be between 20 and 30 pounds and the angle cock was only partially opened to provide a gradual reduction.

Train No. 2d 96 was made up, inspected and tested on the evening of January 29, five inspectors working on this train, the inspection and test consuming 45 minutes. Two air hose were replaced, piston travel was adjusted on 7 or 8 cars and retainer pipe connections were tightened on 4 or 5 cars.

The inspection and test of train 3d No. 96 was made on the evening of January 29; two air brake inspectors worked on this train 1 hour and 45 minutes. In making the inspection and test of the brake equipment on this train the inspectors divided it up into four sections of 10 or 12 cars each and made the inspection, test and repairs necessary on each of these sections separately. One dust collector was replaced on a car in this train and the piston travel was adjusted on 6 or 7 cars, and 2 leaky retainer pipes were tightened. On one car a leaky check valve cane gasket was found and the brake on this car was cut out. When train 3d No. 96 was about to leave the yard the inspectors were present and one of them informed the engineman that his train consisted of 43 cars, 1 brake being cut out. A road test was made between 1:40 and 1:50 a.m., January 30, and the brakes applied and released properly to the rear end of the train.

Time table rule No. 336 requires that a terminal test of the brakes must be made on freight trains before descending the grade south of Keating Summit. This rule is as follows:

336. Southward freight trains between Keating Summit and Sizerville must observe following regulations before descending grade between above points.

Air brakes must be operative on not less than 85 per cent of the total number of cars in the train, which must be tested in accordance with Rule 4, (Terminal Test), first paragraph of the Air Brake and Train Air Signal Instruction Book, which reads as follows: "As soon as the locomotive is coupled to a train and the required pressure is equalized throughout the train, the engineman, upon request of a trainman or inspector, shall make a full service application of the brakes (35 pounds reduction of pressure), and hold them on until the trainmen or inspectors shall have examined the brakes on the tender and on each car. If the trainmen or inspectors find the brakes in proper condition they shall signal from the rear end of the train to the engineman, who shall release the brakes. A test of the brakes is not complete until the trainmen or inspectors have re-examined the brakes as quickly as possible, to know that they have released properly, without the use of release valve, after which they must report to the engineman the condition of the brakes and the number of air brake cars in service in the train."

It is the practice to make the terminal test required by this rule either at Port Allegany, 11 miles from Keating Summit, or at Relay, 4 miles from Keating Summit. Helper engines are coupled on either at Port Allegany or Relay and the brake system is connected through to include those engines and their tenders. After these helper engines are coupled on tests are made to insure that the brakes are working through to the rear end.

Brakeman Sage of 3rd No. 96, who made the air brake inspection at Port Allegany, stated that in addition to the brakes that leaked off he found a few cars in this train with rather long piston travel, but he did not notify the conductor or engineman because he supposed the cars came from Olean in this condition. He thought there were 5 or 6 cars with piston travel of more than 8 inches but none over 10 or 11 inches.

Time table rule No. 336 reads as follows:

336. Trains on descending grades must be controlled by means of air brake, supplemented by the application of hand brakes to such an extent as may be necessary to secure the safe movement of the train.

Under this rule in case the tests made at Port Allegany or Relay indicate that the air brakes are not in proper condition to hold the train on the grade south of Keating Summit the crew is expected to apply the necessary number of hand brakes before starting down this grade.

The investigation disclosed that it has not been customary to use hand brakes on this grade. Engineman Scanlon of 2nd No. 96 stated that he had never before called for hand brakes on this grade. Conductor Nelson of this train stated that after starting down the grade he started to set a couple of hand brakes as was his custom with a loaded short train, and he had set one brake before he heard the engineman's whistle signal for hand brakes. Conductor Nelson said he heard the brakeman tell the engineman all the brakes were working but four and stated that if he had said seven instead of four then he would have looked into it as they would not have had 85% air brakes. Engineman Baker of 3rd No. 96 stated he did not ask to have any hand brakes set because he thought he could hold the train all right. Other employees stated they had not set any hand brakes on this grade for several years.

Since this accident occurred southbound freight trains on this division have received a form 19 order, dated Feb. 6, 1913, Port Allegany, reading as follows:

> All freight trains south:
> Set up fifteen (15) hand brakes which work with the air on head end of your train before tipping over Keating hill.

In accordance with this order it has been the practice to set up the specified number of hand brakes while trains are ascending the grade north of Keating Summit and to leave them applied until the train reaches the foot of the grade south of Keating Summit.

Time table rule No. 340 reads as follows:

> 340: Freight train enginemen, before starting down heavy descending grades, must place brake valve handle in full release position to obtain maximum air pressure in train.

Under this rule it is the practice for freight train enginemen to place the brake valve handle in full release position about a mile north of Keating Summit; full main reservoir pressure of 100 pounds is thereby supplied to the train line before the train starts down the grade.

Retainers are also turned up north of Keating Summit and left up while the train is descending this grade.

Freight trains ordinarily do not stop at Keating Summit. After the train starts down the descending grade south of Keating Summit the angle cock is closed between the pusher engines and the rear car in the train and the helper engines are cut off.

There are no air gauges in the cabooses on these trains and the members of the crew on the rear end of the train have no definite information regarding the condition of the brake system while the trains are going down the grade.

After the accident employees of the railroad made a test of the brakes on the twenty cars in the rear end of train 3d No. 96. On account of train line leakage it was necessary to apply the brakes three times in making this test. On one car the brake was cut out, and on six others the brakes would not apply in a service application; all except the one which was cut out operated when an emergency application was made. Another examination and test of the brakes on these cars was made later, and the report regarding this examination and test indicated that on 13 cars, or 61 per cent, the brakes were not in proper condition for use on mountain grades.

During the investigation of this accident the train sheets and block records were checked for a period of fifteen days prior to and five days following the date of the accident, and these records indicate that for the period covered the speed restriction prescribed for freight trains on Keating Summit grade was generally adhered to.

While checking up the air brake practices on this division, one train was inspected and tested at Port Allegany on February 15, 1913, in which there were 47 cars; the brakes on one car were cut out, one was carded as defective but not cut out; and six others did not apply, making a total of 8 cars on which the brakes were not working; counting engine and tender, only 83.7% of the brakes in this train were in proper operating condition. This train was made up at Buffalo, and the records there indicate that the train left that point with 100% of the brakes working; some of the cars in this train were taken from tracks on which there was no yard air line; no opportunity is afforded to make a test of cars on these tracks until the road engine couples on preparatory to starting out, and it is believed that the defective cars came chiefly from these tracks. The reason given for not cutting out the brakes carded as defective is that they might apply in an emergency application. In other trains inspected at Port Allegany, the percentage of brakes in proper working condition was 89, 89 and 93% respectively.

There are no air brake inspectors at Port Allegany or Relay and no repairs are made at these points. The inspections and tests required are intended to supply the train crews with information to enable them to determine the number of hand brakes which should be set in order to hold the trains on the

grade south of Keating Summit.

This accident was caused by the running away of a freight train on a mountain grade.

A number of conditions led up to this runaway and made it possible. In the first place, the failure of the brakes in this train to operate properly to control the train on this grade, and the results of tests made on the cars not destroyed in the collision demonstrate beyond question that the brakes in this train were not in proper condition for use on a mountain grade. Secondly, the statements of employees indicate that this train was running at a comparatively high rate of speed at Keating Summit and that it gained considerable momentum before the brakes were applied. Furthermore the extreme cold no doubt accentuated the bad condition of the brakes. Not only would the low temperature affect the piston packing leathers, but also the brake shoes would require a longer period of time to become warmed up and effective in retarding the momentum of the train.

All the employees involved in this accident were experienced men who were familiar with the operating conditions on this division, and the investigation disclosed that in operating both of the trains involved in the accident the usual practices and methods were followed.

The records indicate that these two trains ran from Keating Summit to Sizerville in eleven minutes at an average rate of speed of 42 miles per hour. The estimated speed of both trains at the top of the grade was approximately 15 miles per hour, and one of them was again under control at Sizerville. Both trains must therefore necessarily have attained a very high rate of speed on the grade. That this should occur in the case of both of these trains when the usual practices were generally observed, even under the somewhat unusual conditions brought about by the extreme cold, indicates a serious condition demanding additional protective or precautionary measures.

To insure the safe operation of heavy freight trains down this grade it is believed that trains which are made up at Buffalo or Olean should not be permitted to leave those terminals with any cars having air brakes in defective condition, whether cut in or out, or with brakes cut out of service; trains leaving these points and going over this grade should have 100 per cent of the cars equipped with brakes in proper working condition. Air brake inspectors should be stationed at the point where the test specified in timetable rule No. 636 is made; these inspectors in addition to making this test should also make necessary adjustments and repairs, holding trains for that purpose when required to do so.

It appears that the proper place to make the tests required by timetable rule No. 336 is at Keating Summit. If tests were made at that point and necessary repairs and adjustments made, there could then be no question but that the brakes would be in proper working condition at the time the train started down the grade. But if for any reason it is not feasible to make these tests at Keating Summit, and the practice of making the tests at Port Allegany or Kelay is continued, it is believed that freight trains should be brought to a stop by means of the air brakes immediately after tipping over the crest of the hill at Keating Summit, to insure that the brakes were in proper condition and also to prevent trains from starting down this hill at high speed. It is the general practice on railroads having mountain grades to stop freight trains at the top of these heavy grades to insure low speed when starting down the grade and so prevent a train from getting beyond control before the brakes can be effectively operated.